Fragmentation function performance

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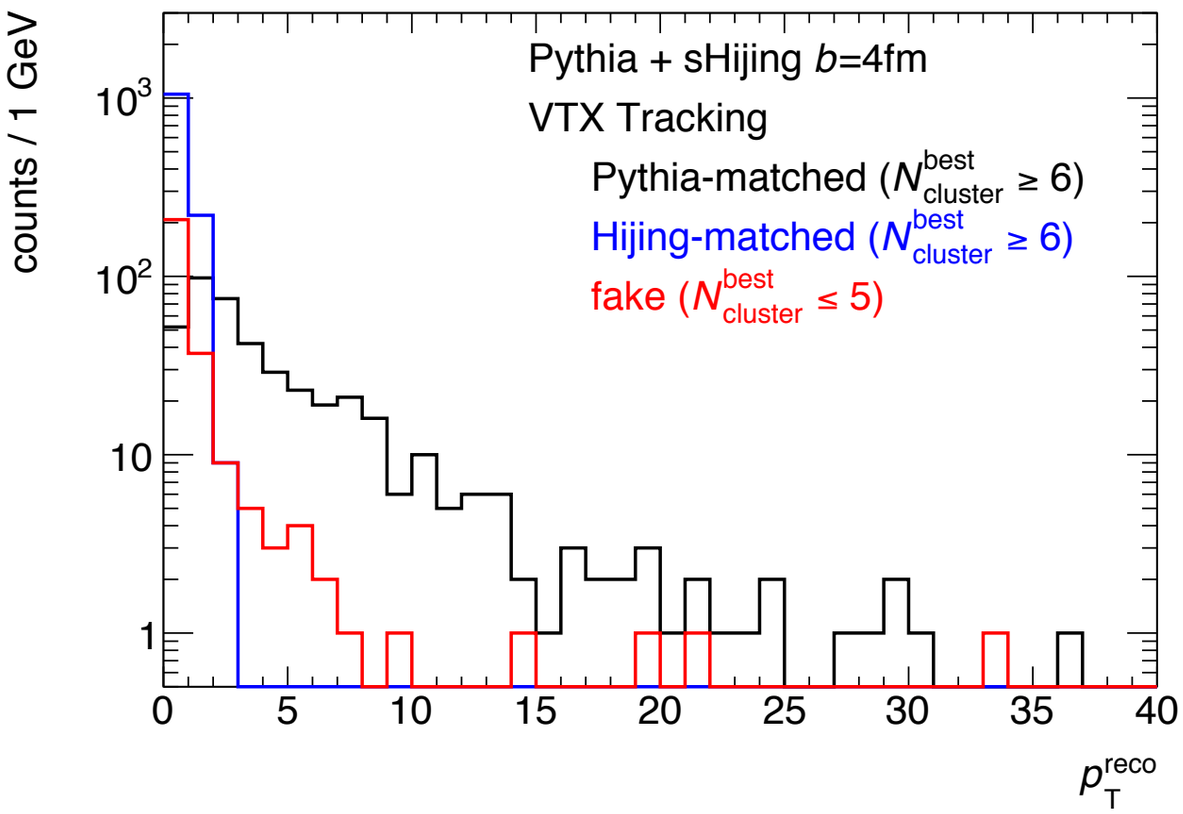
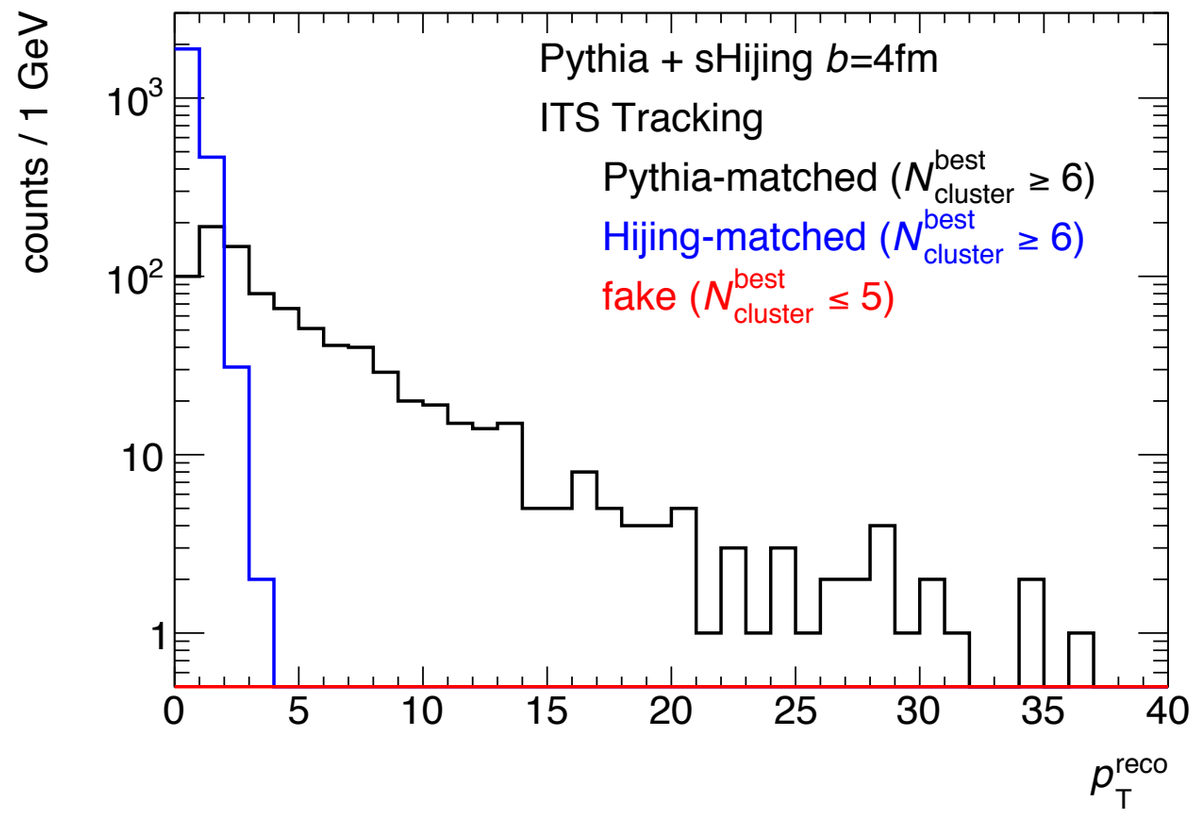
sPHENIX Simulations Meeting

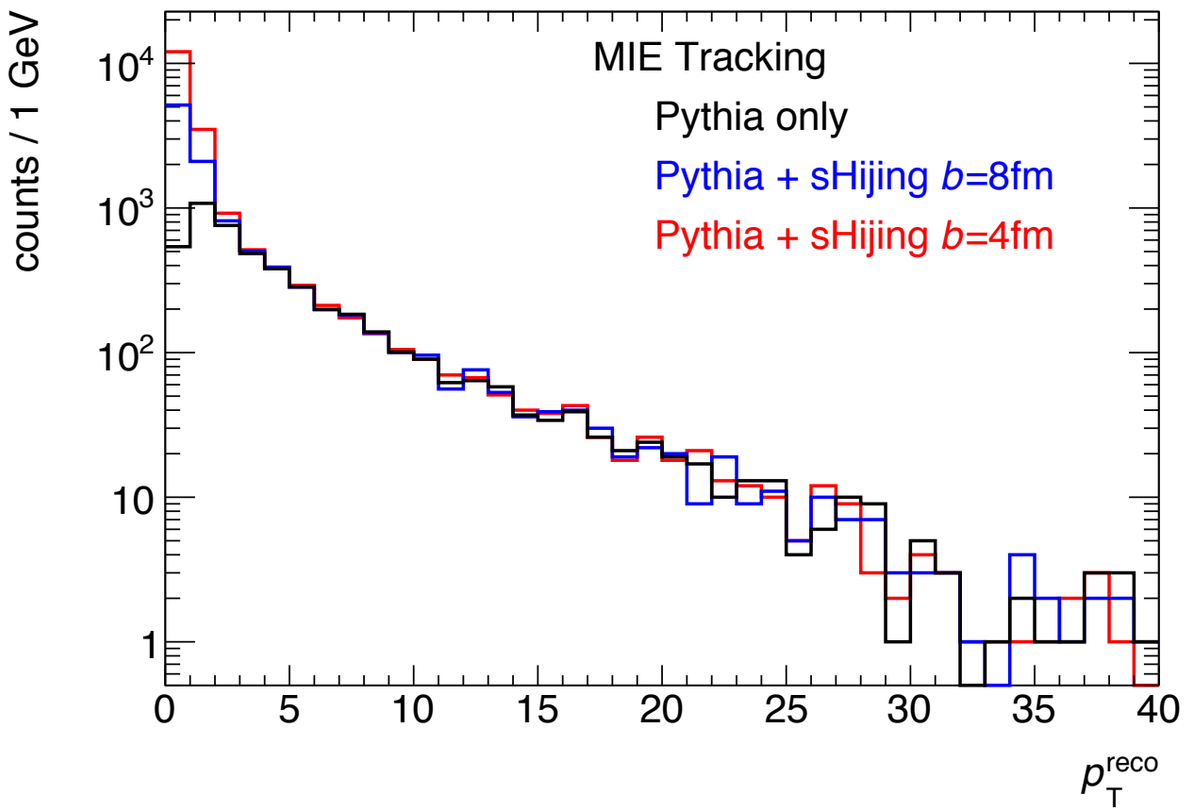
Last time (5 April 2016)

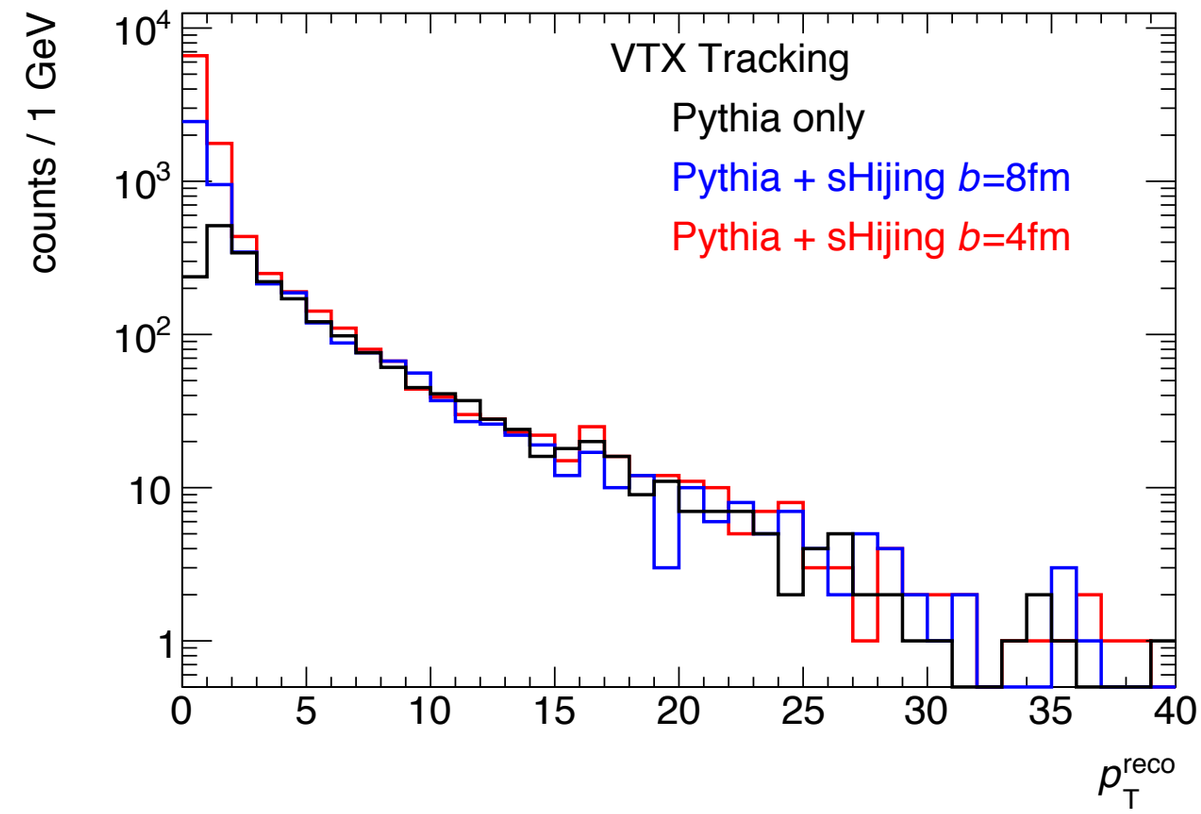


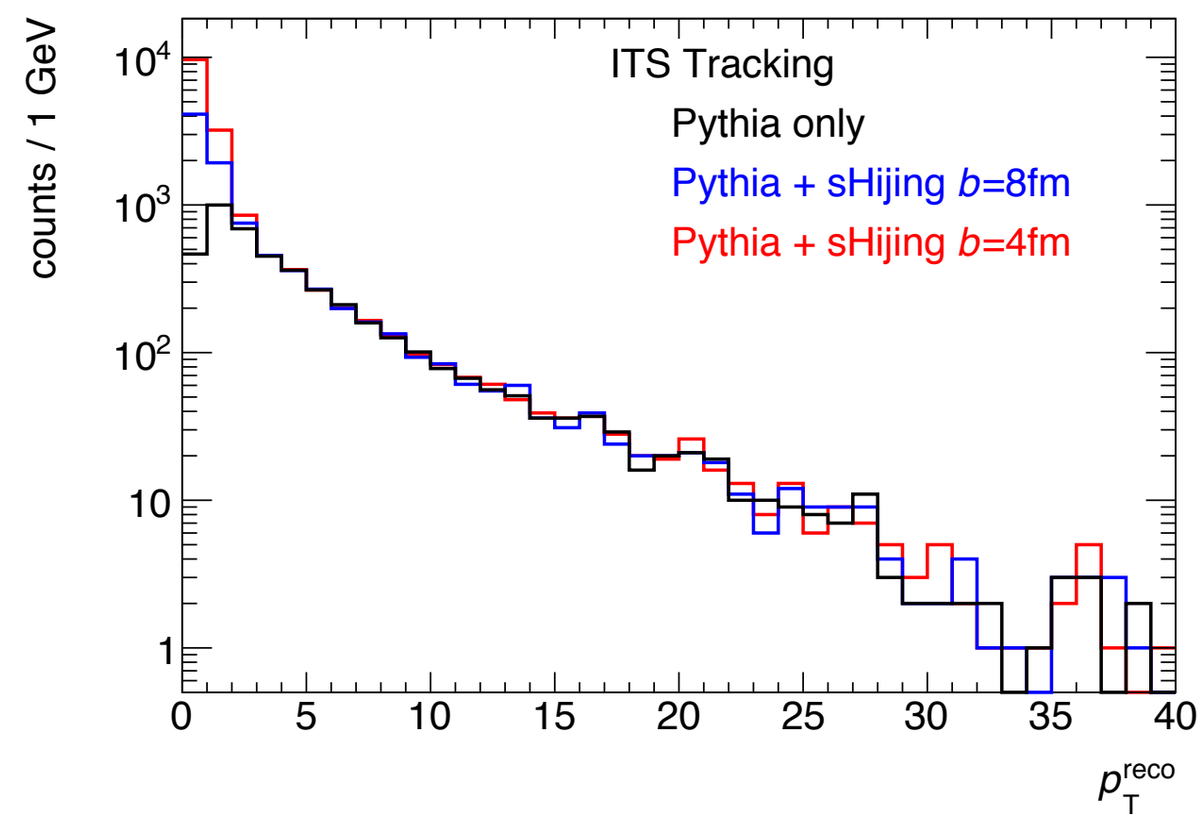


- G4 simulation of tracking in N_{evt} = 200, 40 GeV photon-jet events
  - ➡ comparing three different tracking configurations
  - ➡ comparing pure-Pythia to Pythia embedded in b=4fm and b=8fm sHijing
- In this update: more statistics (N_{evt} = 1000), and answers to some questions that were raised

Updated p_T^{reco} distributions

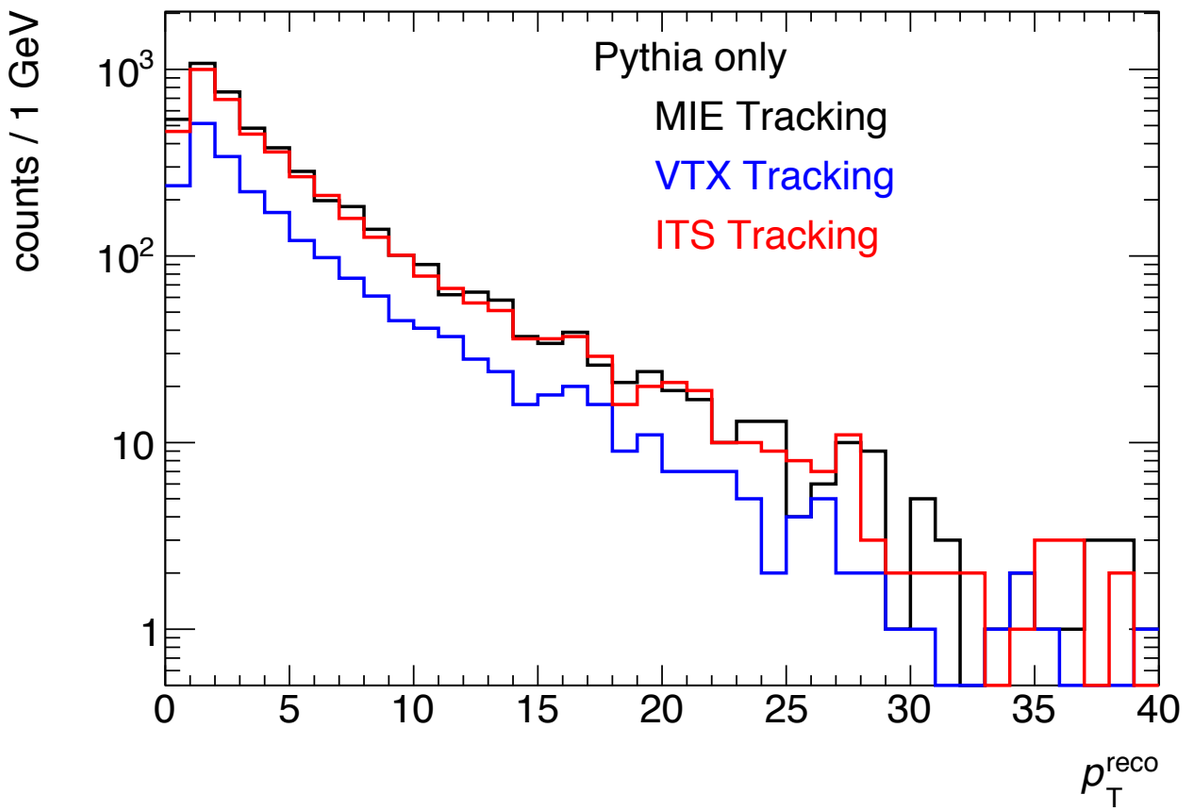


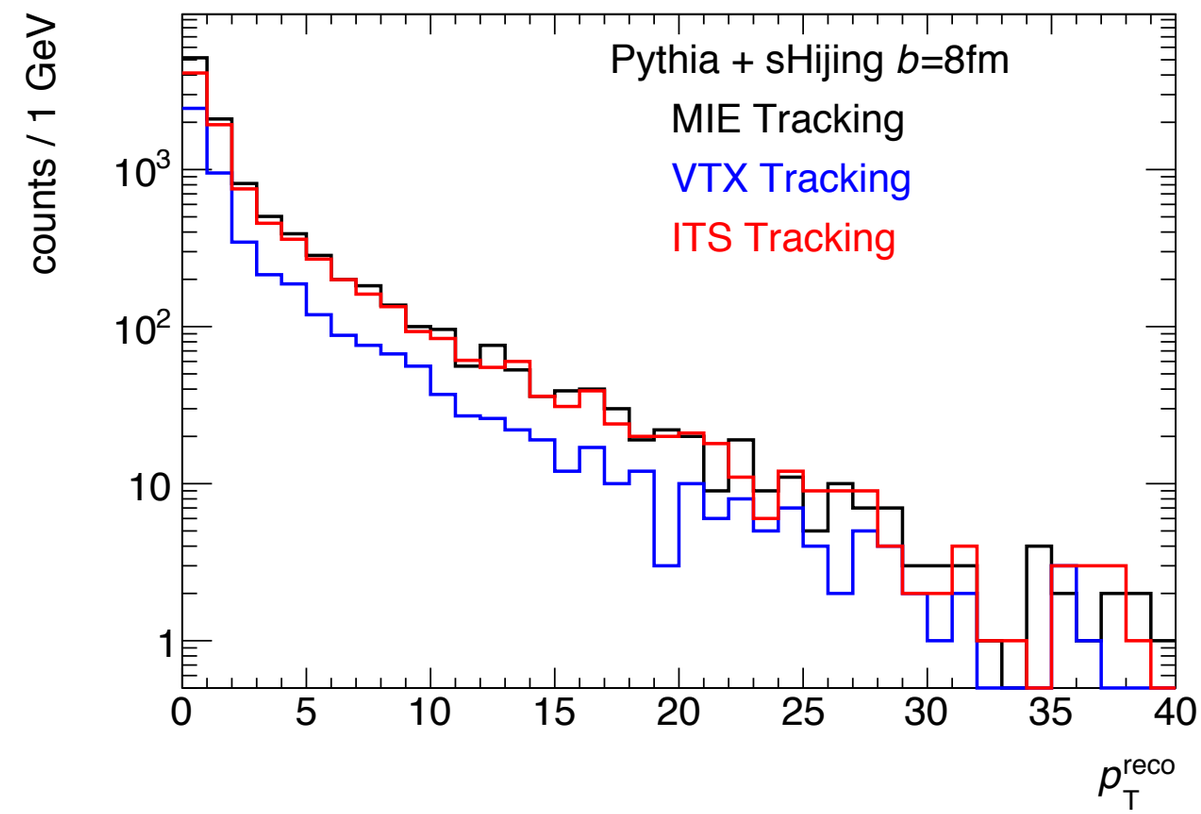


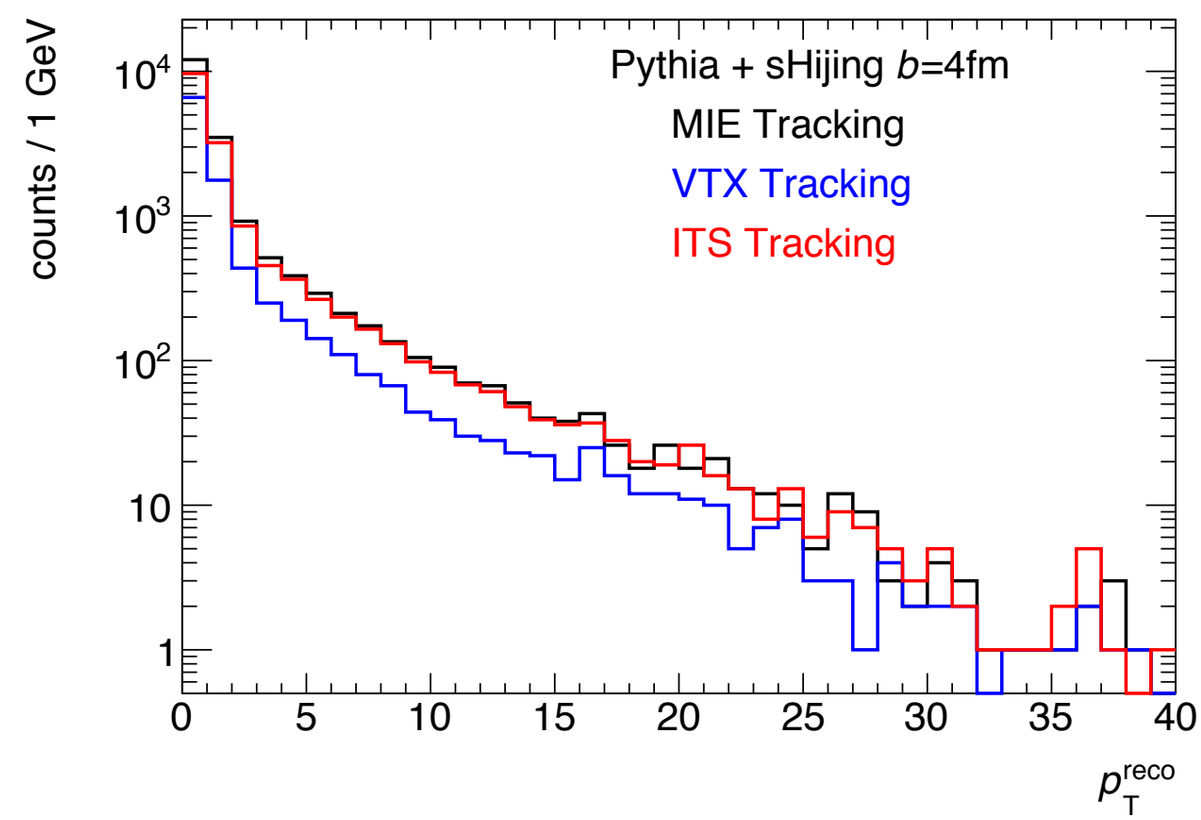


- p_T distribution of all reconstructed tracks within ΔR<0.4 of truth jet
  - ➡ each <u>panel</u> is fixed <u>tracking option</u>
  - ➡ multiple systems (**Pythia**, **b=4fm**, **b=8fm sHijing**) shown on each panel

Updated p_T^{reco} distributions

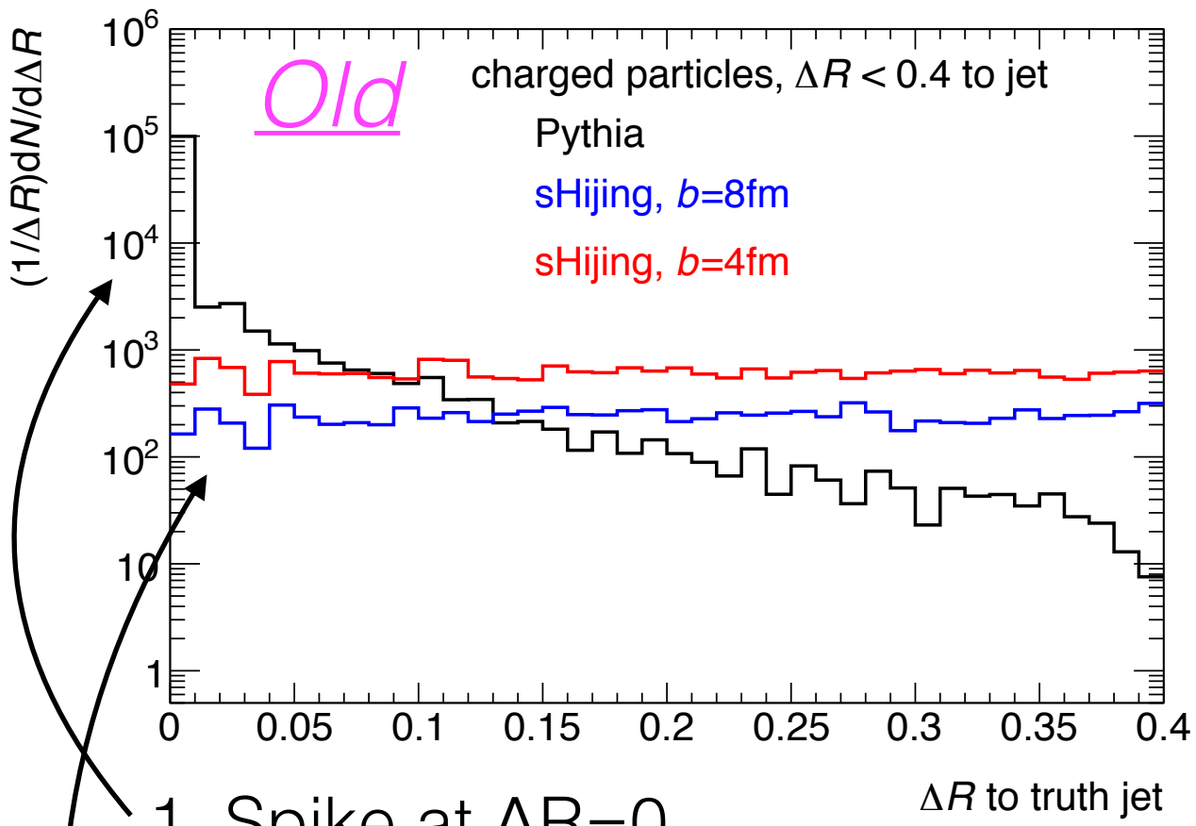


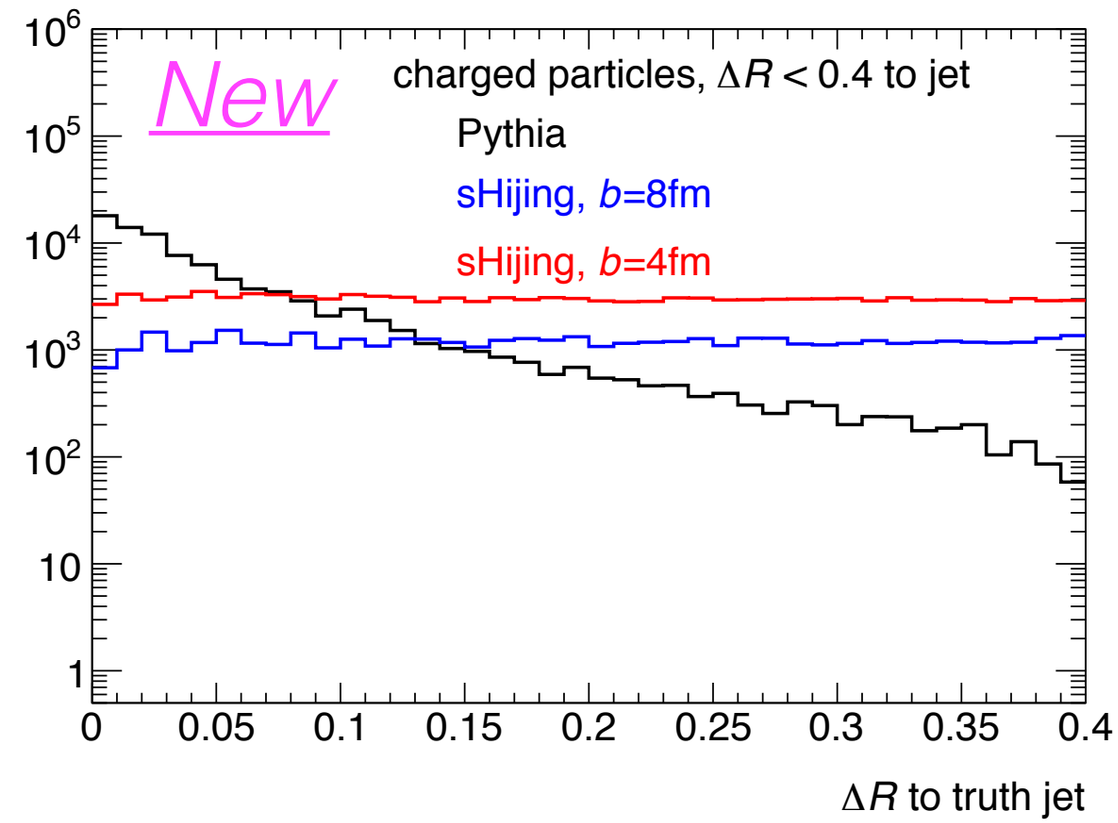




- p_T distribution of all reconstructed tracks within ΔR<0.4 of truth jet
  - ➡ each <u>panel</u> is fixed <u>collision system</u>
  - ➡ multiple configurations (**MIE**, **VTX**, **ITS**) shown on each panel

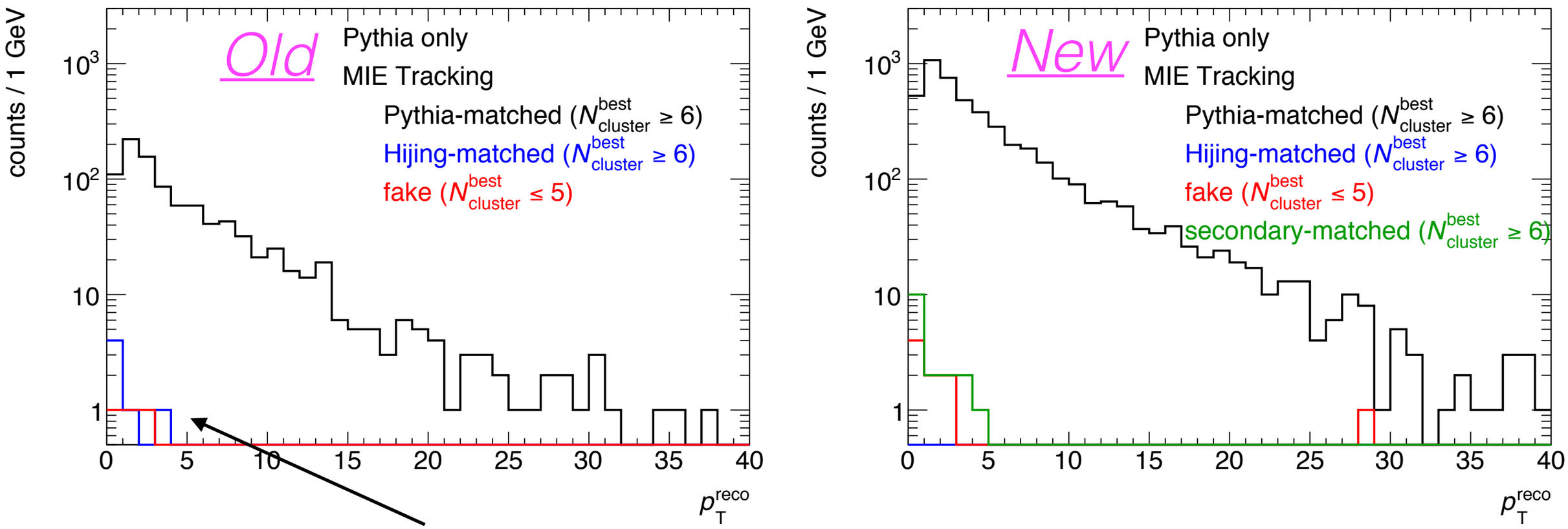
Question: spike / non-statistical behavior in ΔR distribution?





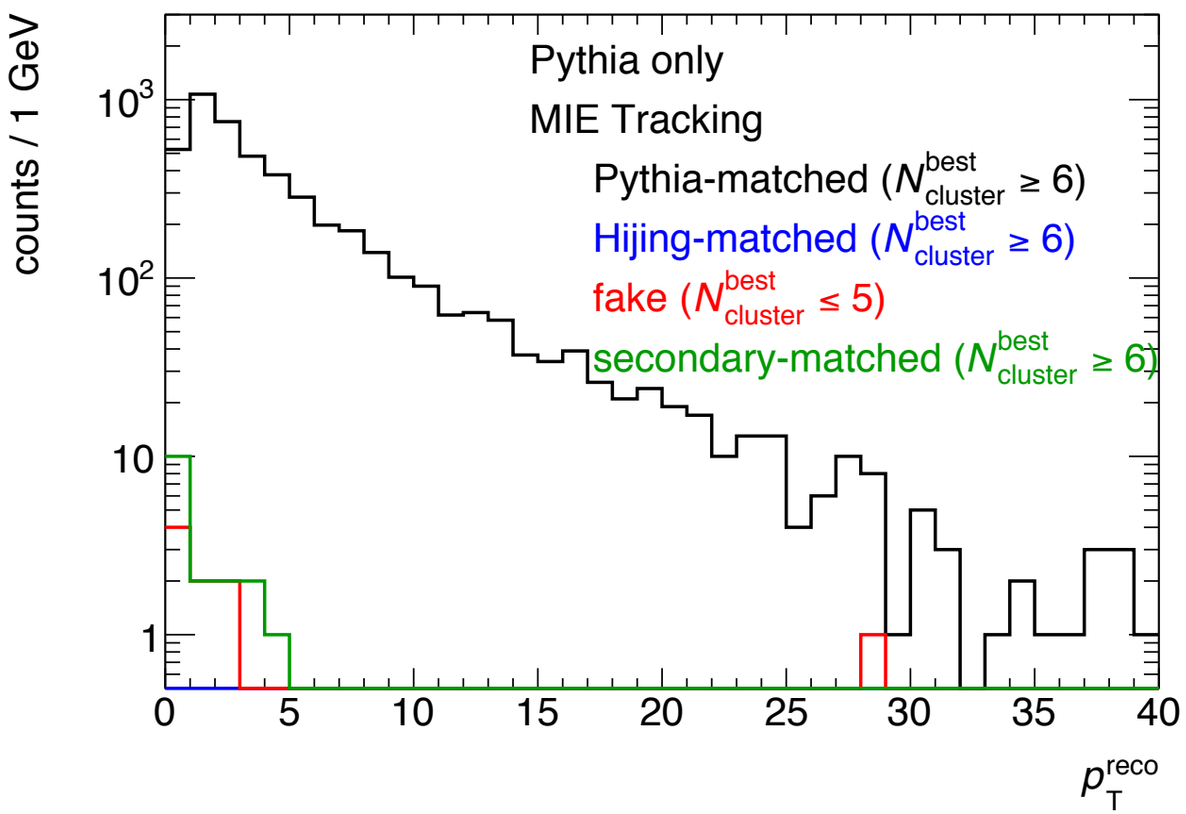
1. Spike at ΔR=0
   - ➡ found that these were caused by $\gamma \rightarrow e^+e^-$ conversions with tiny opening angle I was erroneously treating as jets
   - ➡ also one unlucky case of a Hijing particle lining up with Pythia truth jet, and one "weird" event, but for now I don't bin those two particles
2. "Non-statistical" behavior in b=4 and b=8fm distributions
   - ➡ not sure, went away with more statistics

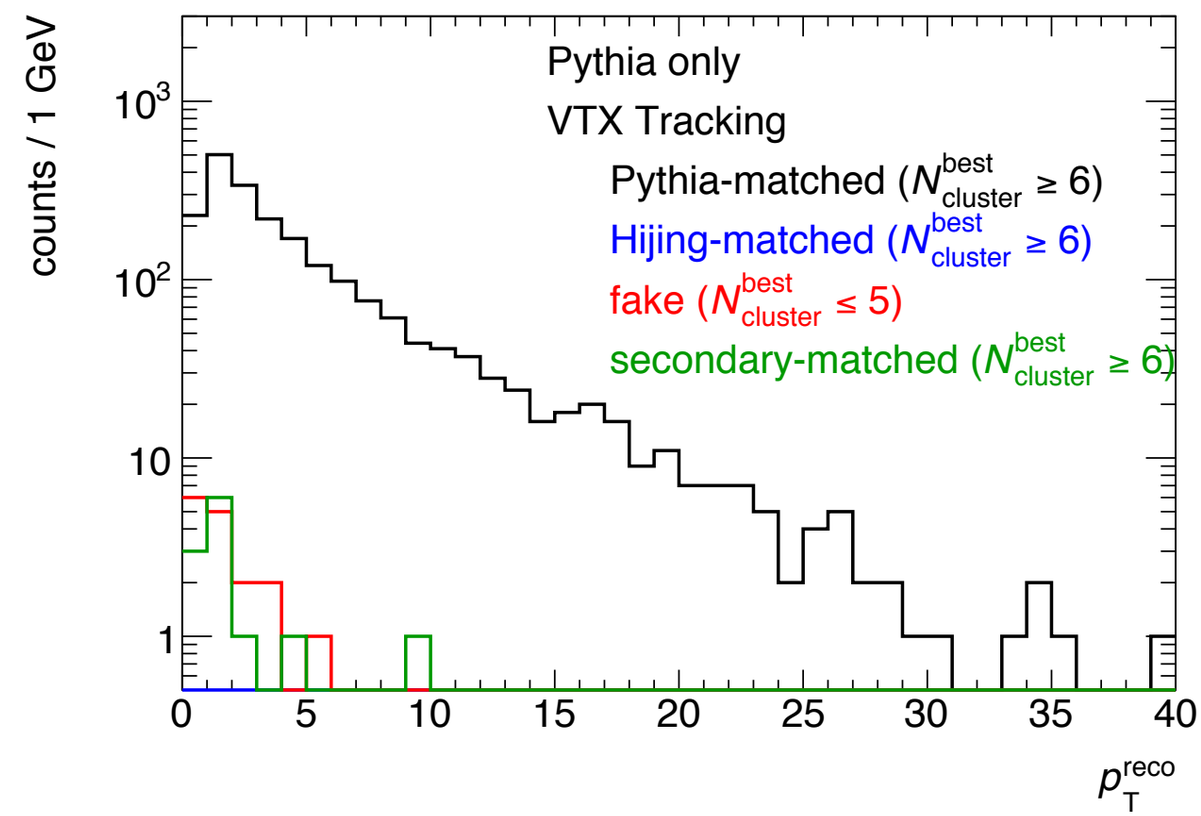
Question: “sHijing”-matches in Pythia-only events?

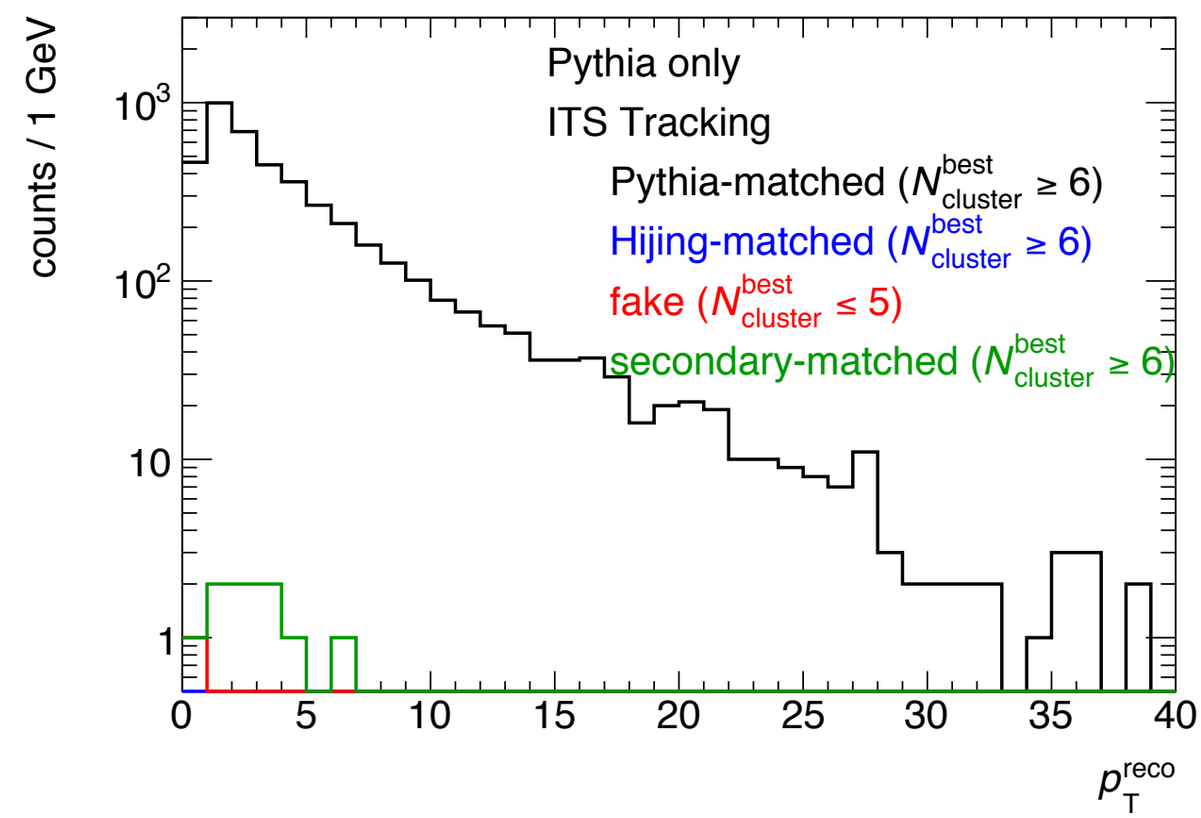


- I found that **these** were actually caused by secondaries
- New scheme:
  - ➡ first check $N_{cluster}^{best}$. If it’s <=5, it’s a **fake**.
  - ➡ then, check if the best truth particle is a **secondary**
  - ➡ then, check if the best truth particle is a **Pythia8** or **sHijing** primary particle

Updated tracks by origin: Pythia only



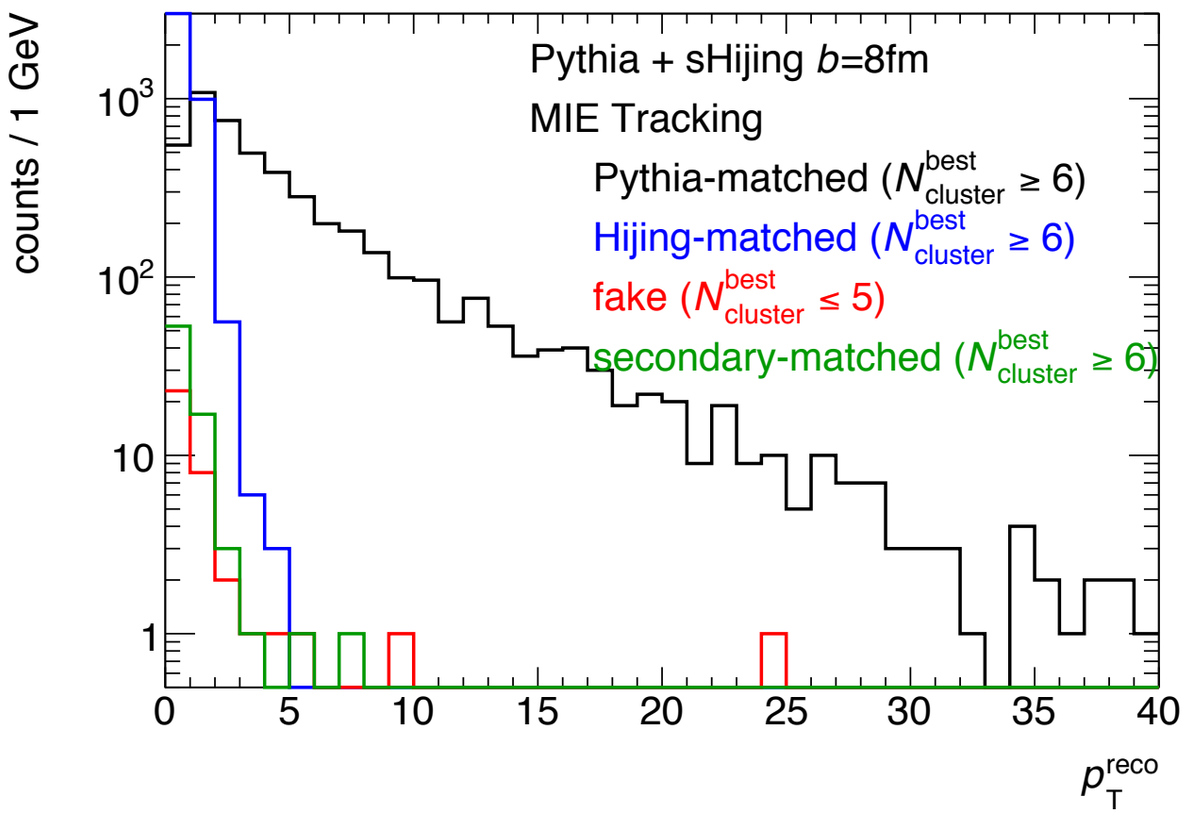


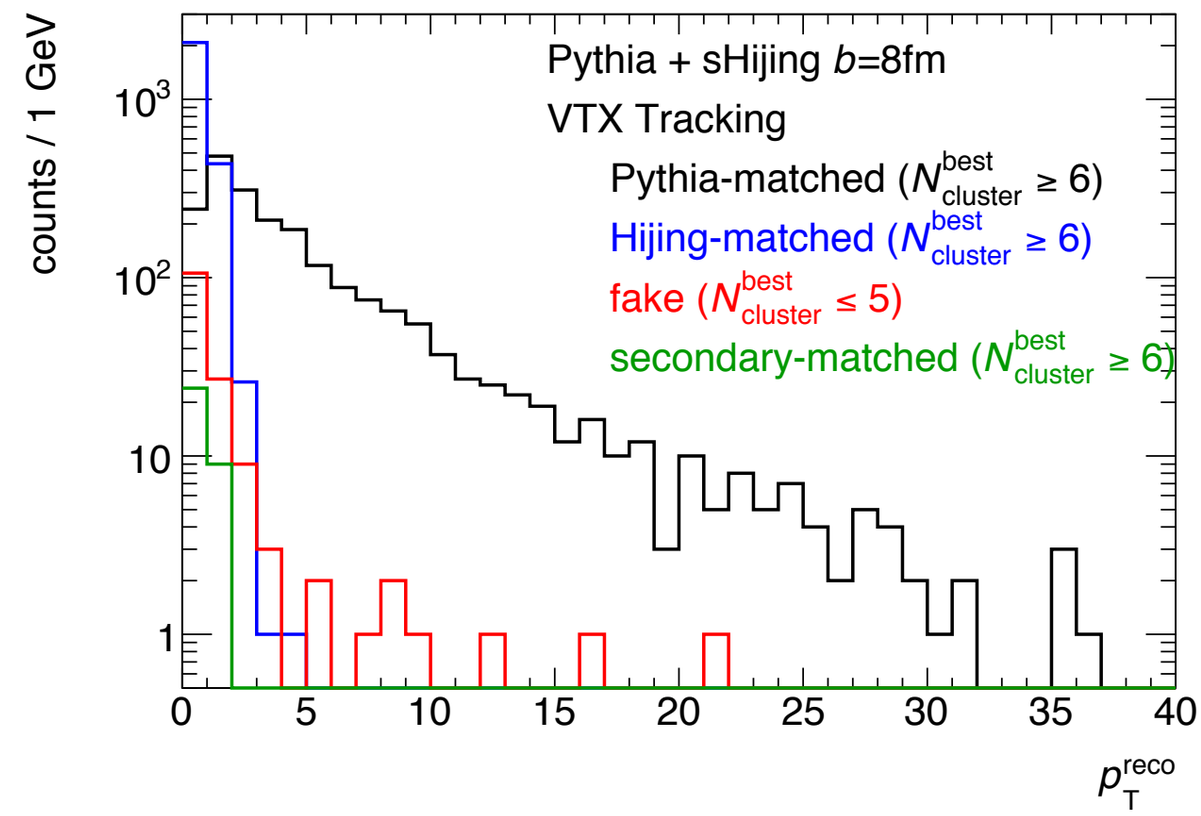


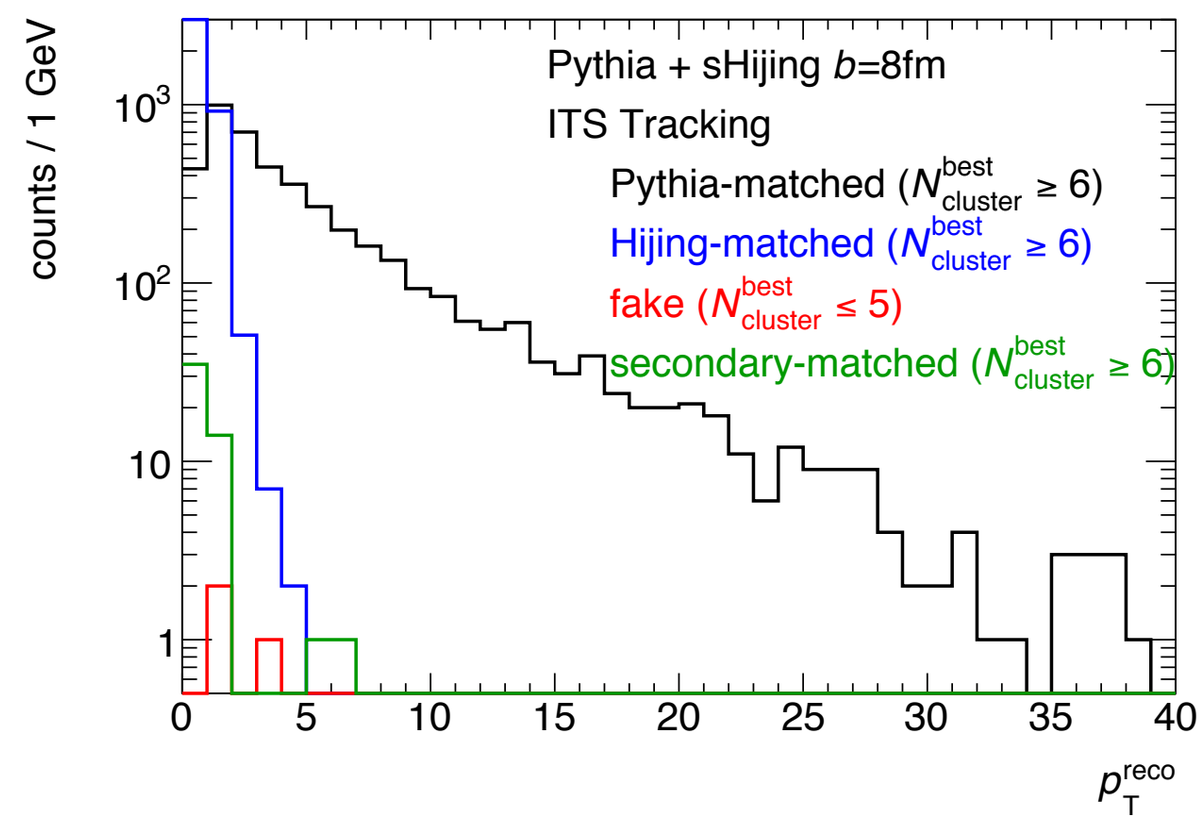
- On this slide, just Pythia
- Each <u>panel</u> is a fixed <u>tracking configuration</u> option

  ➡ breakdown by **Pythia**, **Hijing**, **fake**, **secondaries**

Updated tracks by origin: Pythia+*b*=8fm sHijing only

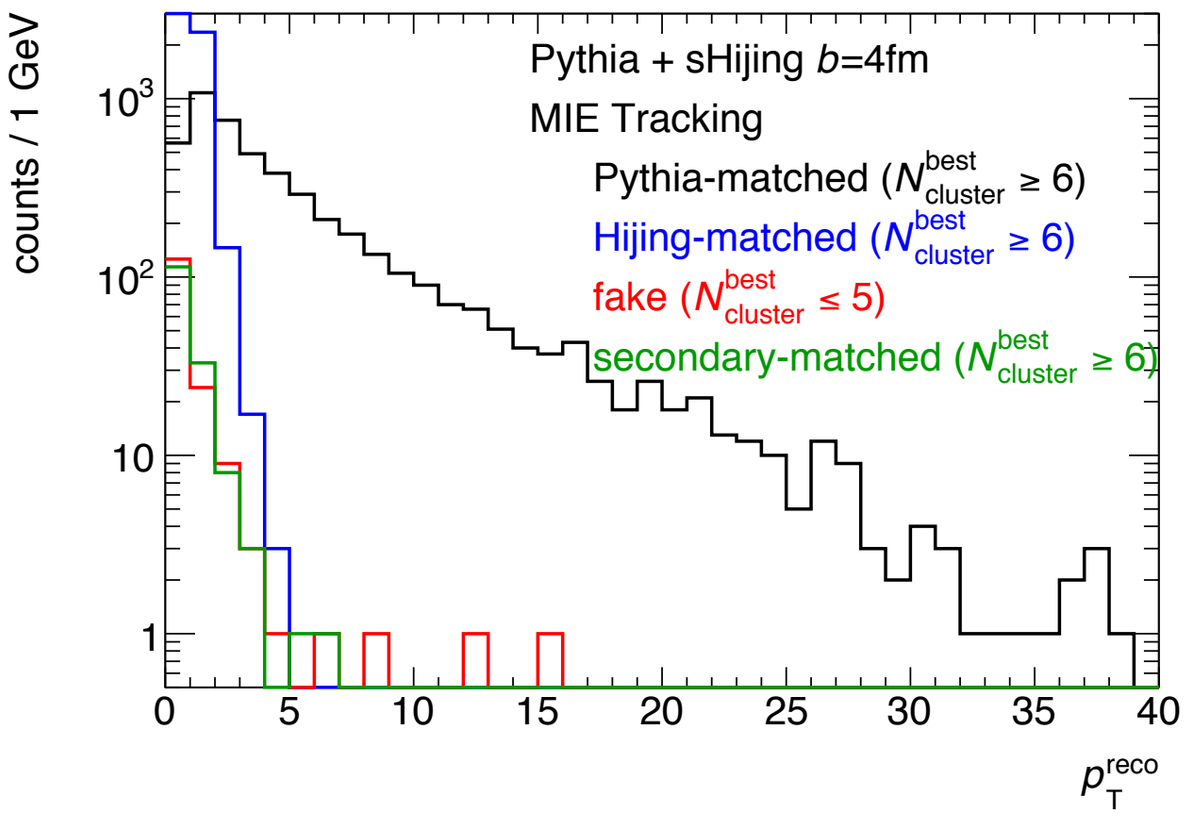


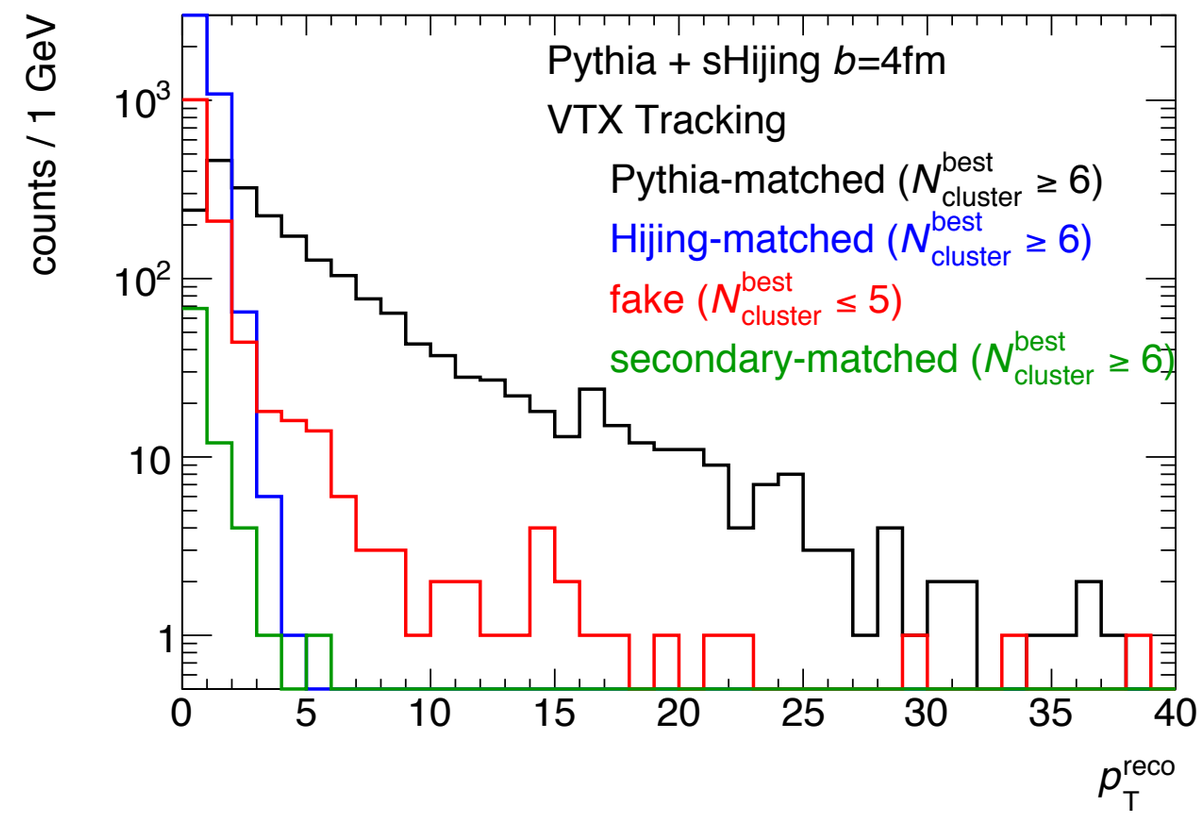


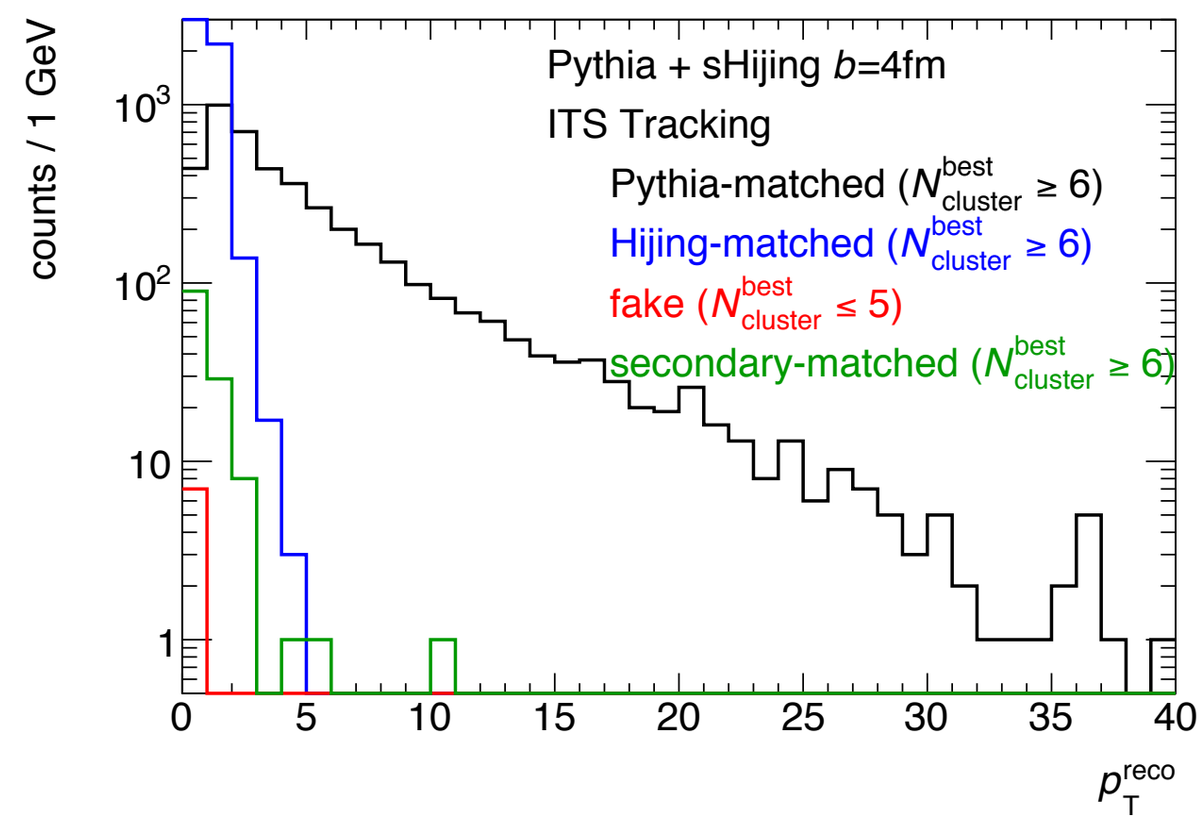


- On this slide, Pythia + *b*=8fm sHijing
- Each <u>panel</u> is a fixed <u>tracking configuration</u> option
  - ➡ breakdown by **Pythia**, **Hijing**, **fake**, **secondaries**

Updated tracks by origin: Pythia+*b*=4fm sHijing only



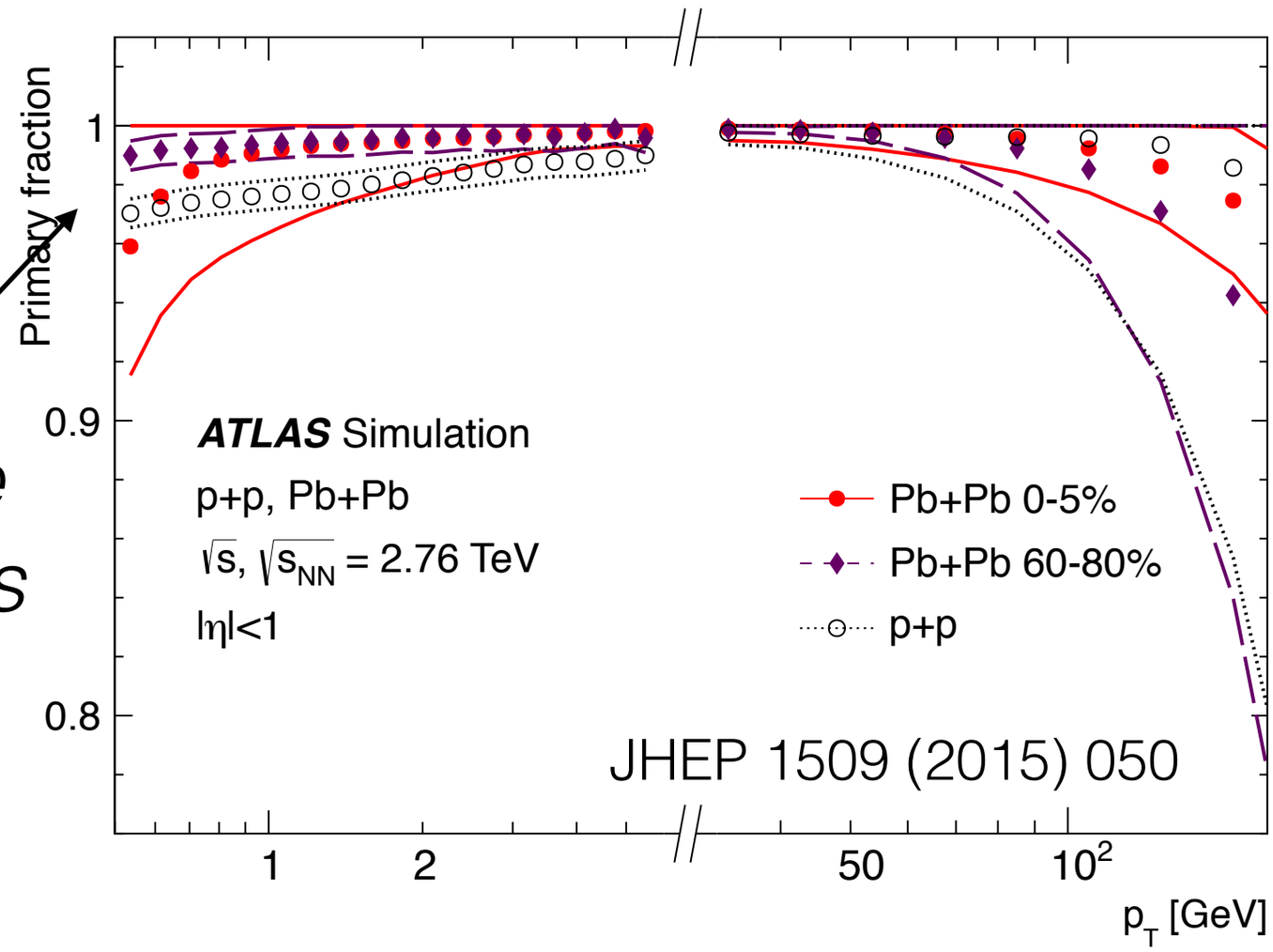




- On this slide, Pythia + *b*=4fm sHijing
- Each <u>panel</u> is a fixed <u>tracking configuration</u> option
  - ➡ breakdown by **Pythia**, **Hijing**, **fake**, **secondaries**

Fakes and secondaries at the LHC

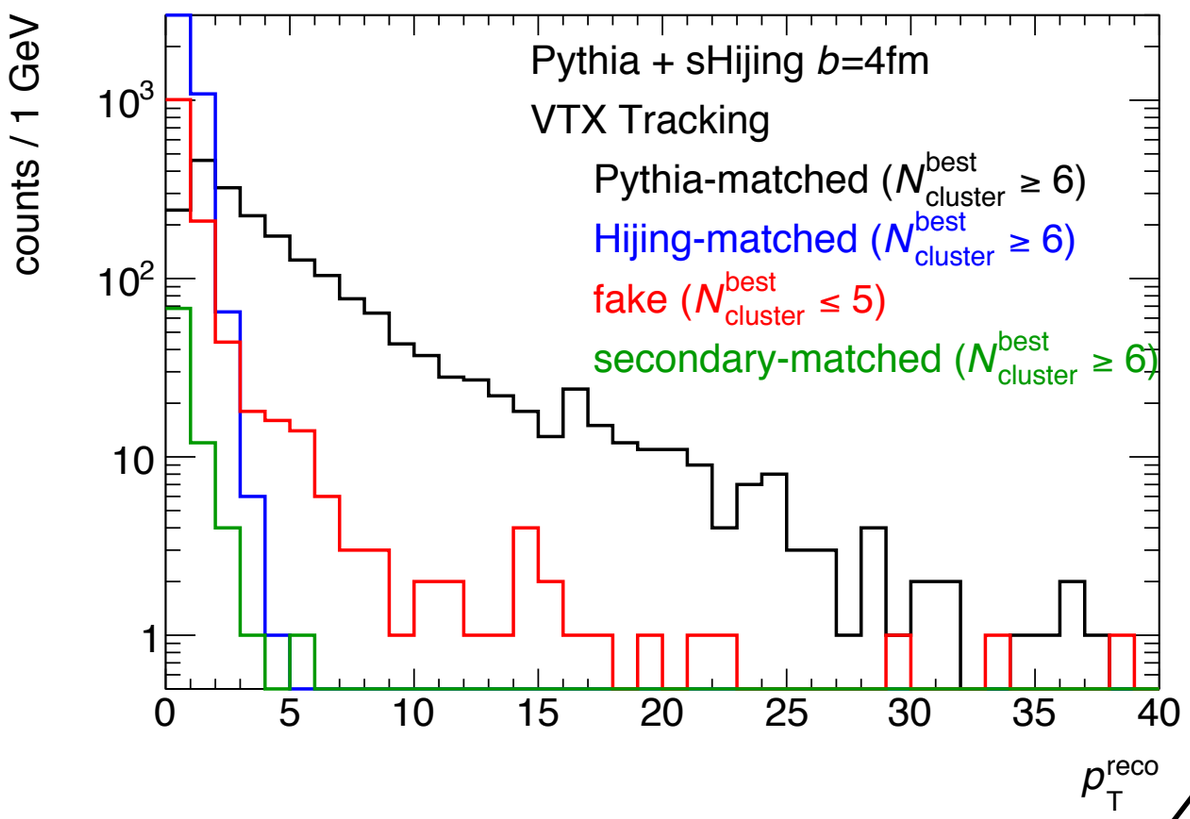
non-unity due to secondaries



non-unity due to fakes

- From recent ATLAS 2.76 TeV Pb+Pb charged particle spectrum measurement
  - ➡ "matching" of high-p_T tracks to reconstructed jets for triggering purposes, and also to keep down fake rate
  - ➡ above: "primary fraction" for different systems, like a purity

Question: how does this compare to other fake rate studies?



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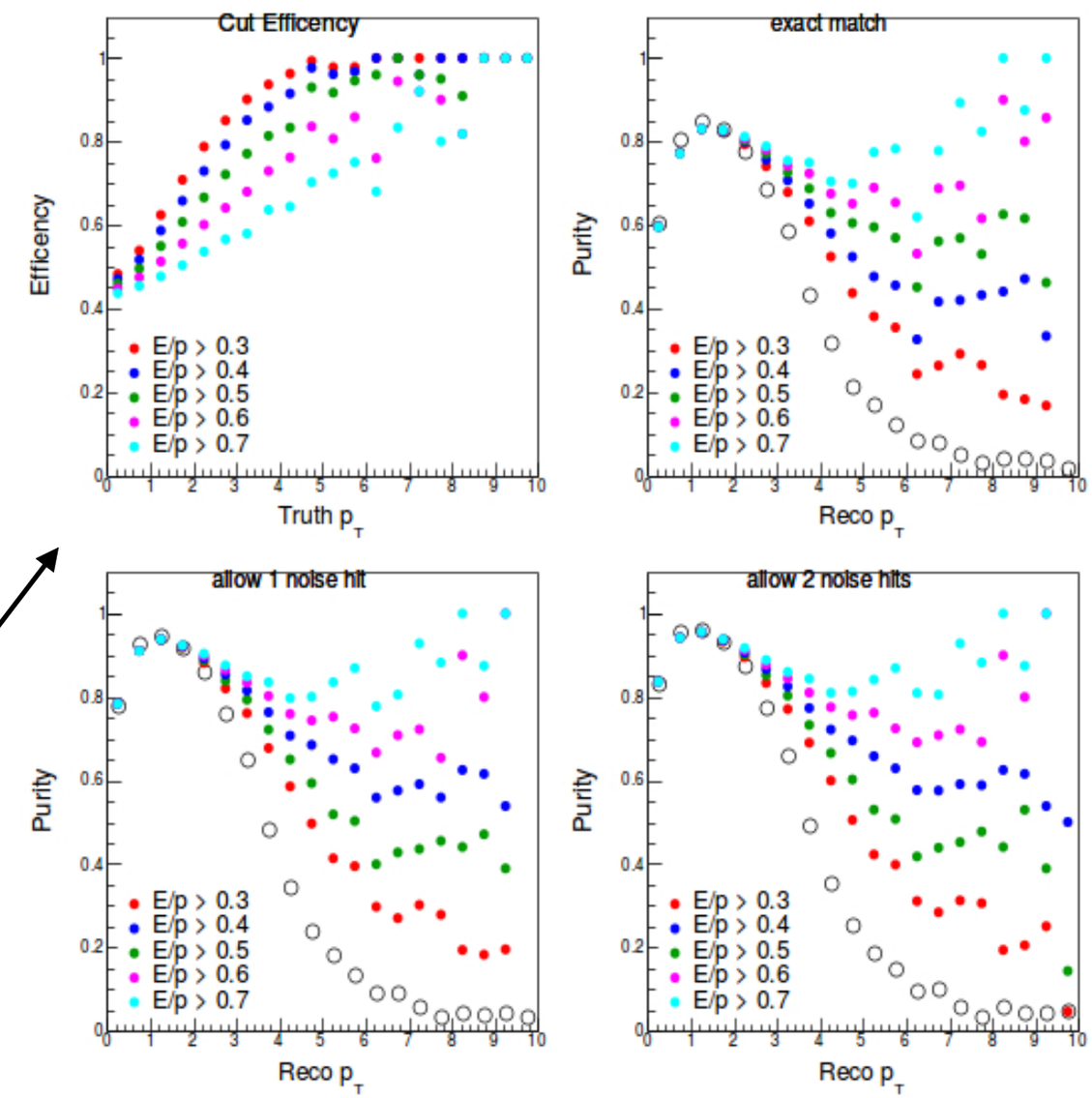
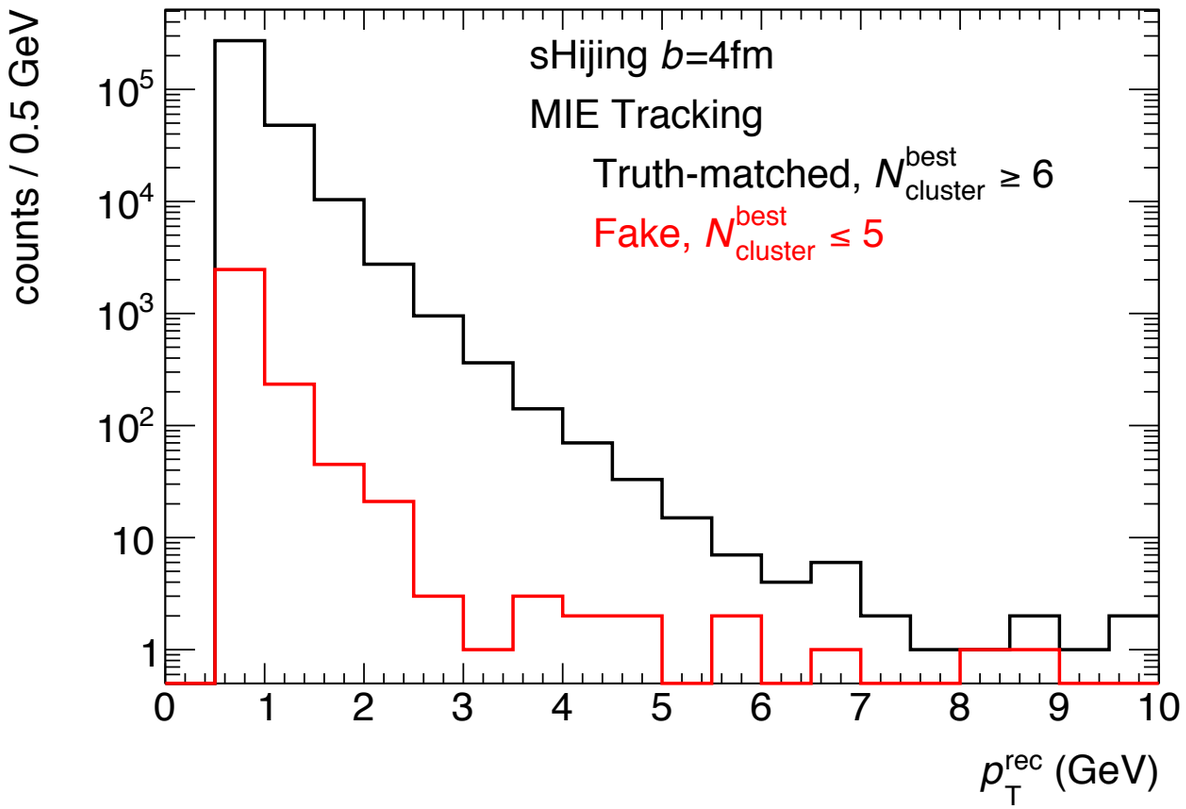


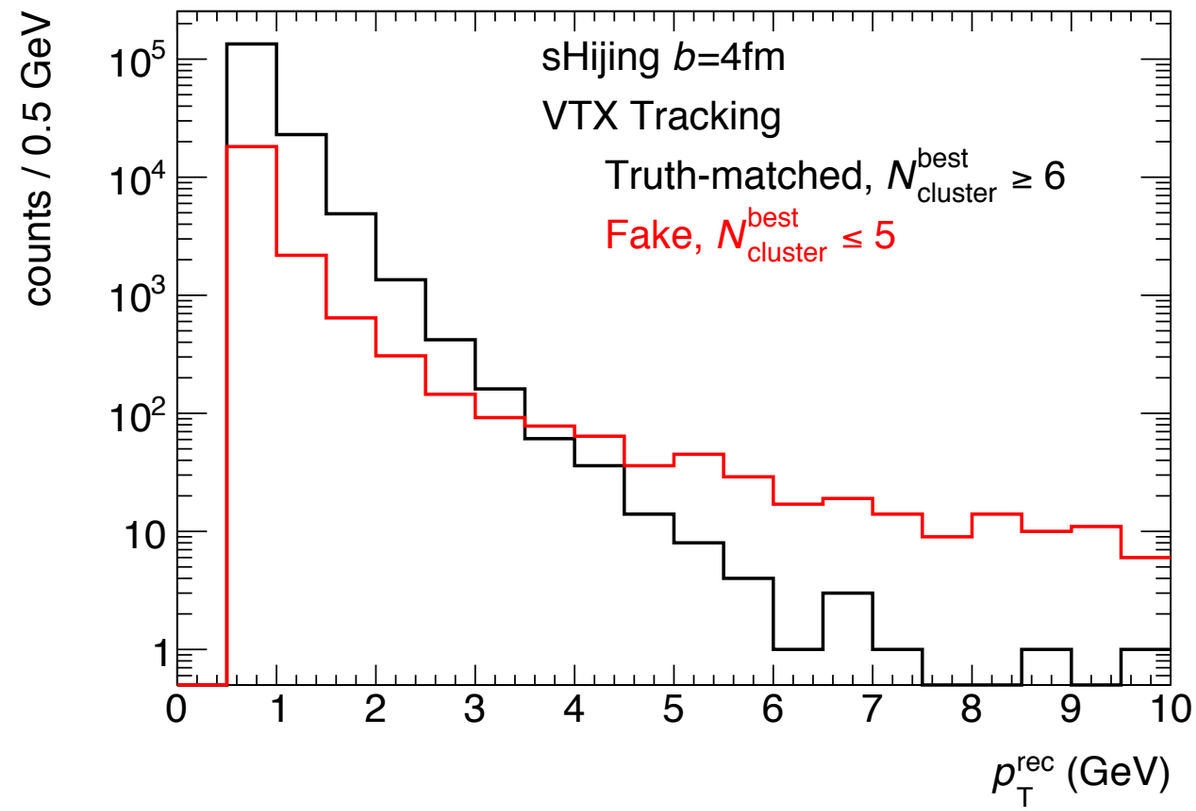
- Two issues:
  - ➡ I'm using *b*=4fm exactly, Kurt & Ron have *b*=0-4fm, and fake rate is potentially strongly *b*-dependent
  - ➡ narrowing to jet cone has larger signal and smaller fake rate

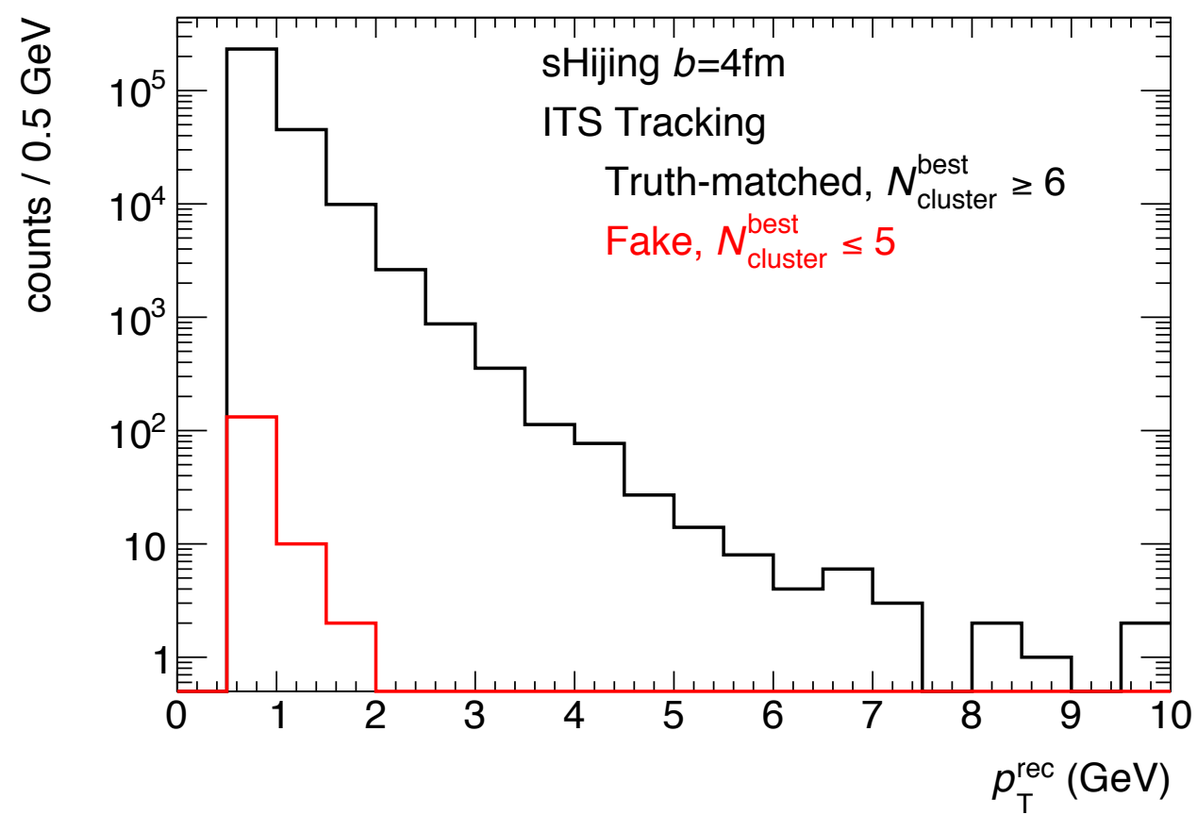
“Inclusive” fake rate

- For a tracking-only measurement, the “inclusive” fake rate throughout the entire event is useful quantity of merit
  - ➡ one can (and experiments have) implement a jet- or cluster-matching
  - ➡ these complicate the measurement but can improve purity
- In my study, split up reconstructed tracks as follows:
  - ➡ if $N_{\mathrm{cluster}}^{\mathrm{best}}$ >= 6, and they are matched to Pythia primary, *discard these tracks*
  - ➡ if $N_{\mathrm{cluster}}^{\mathrm{best}}$ >= 6, and they are matched to Hijing primary or any secondary, call them “<u>real</u>”
  - ➡ if $N_{\mathrm{cluster}}^{\mathrm{best}}$ < 6, call them “<u>fake</u>”
- I’ll just show the *b*=4fm sHijing

Truth-matched vs. fake tracks

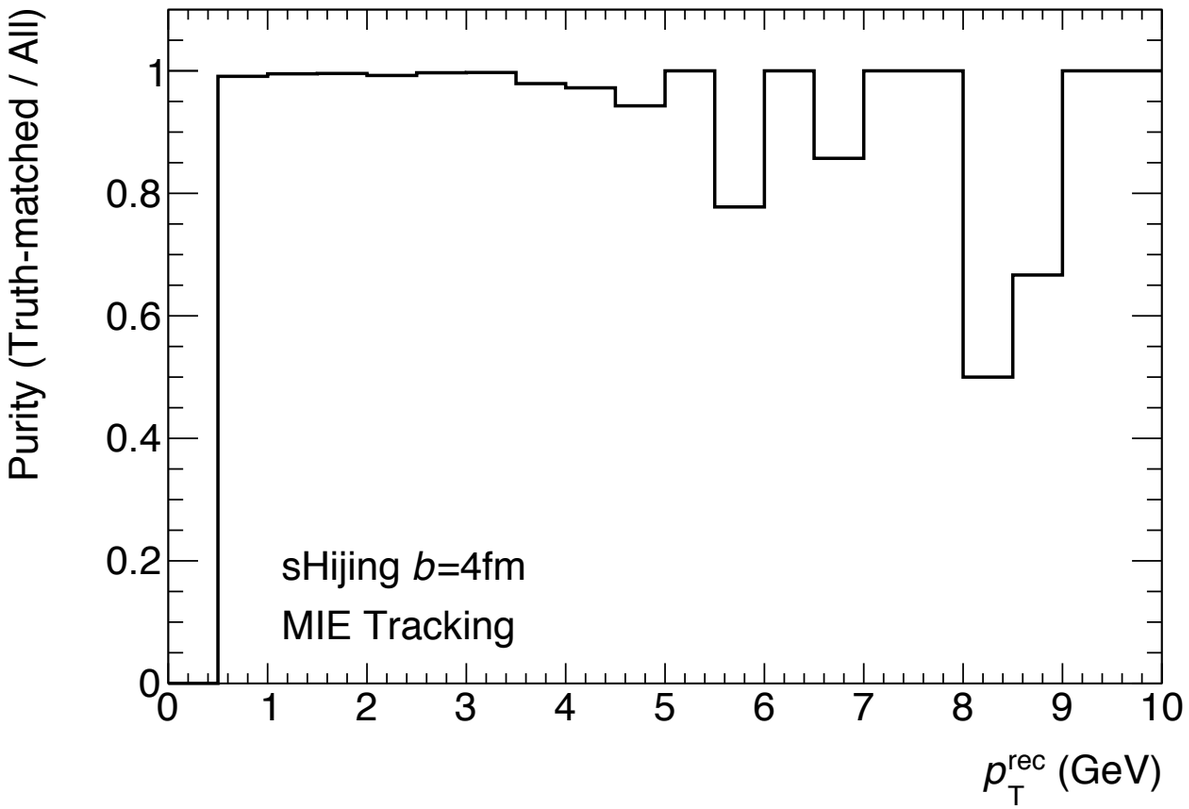


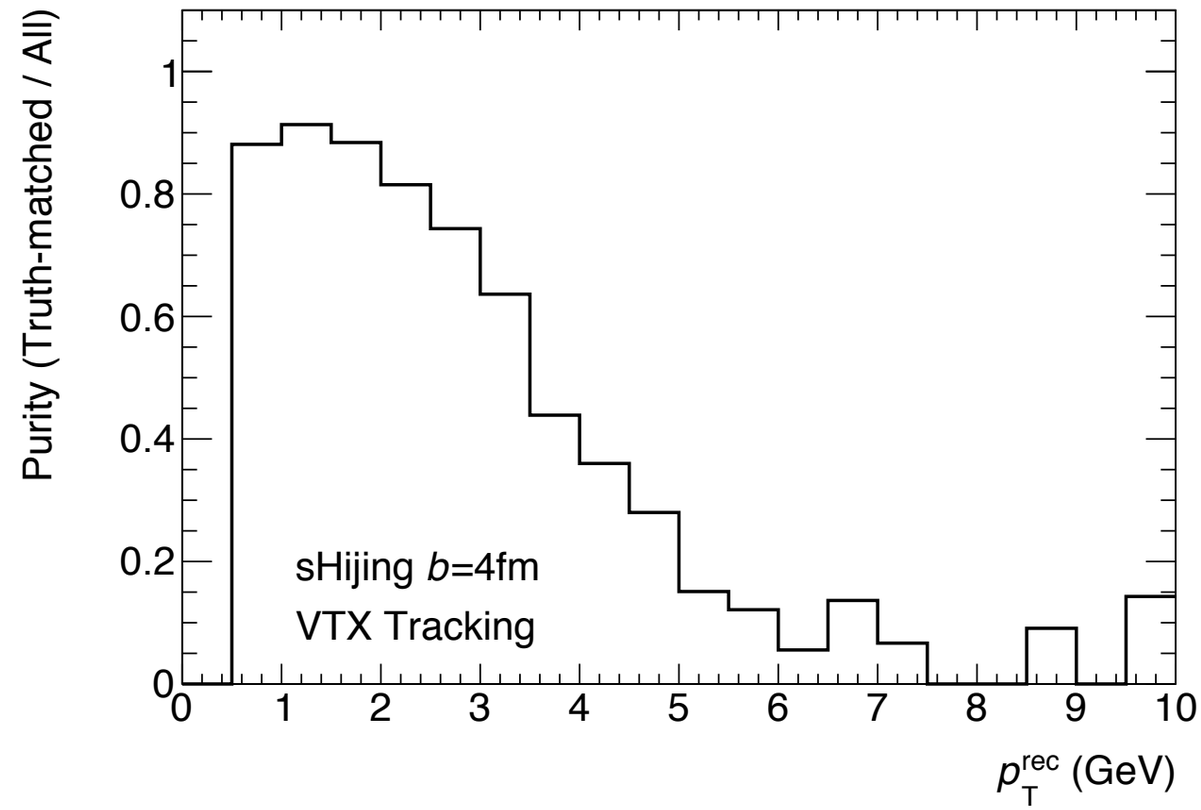


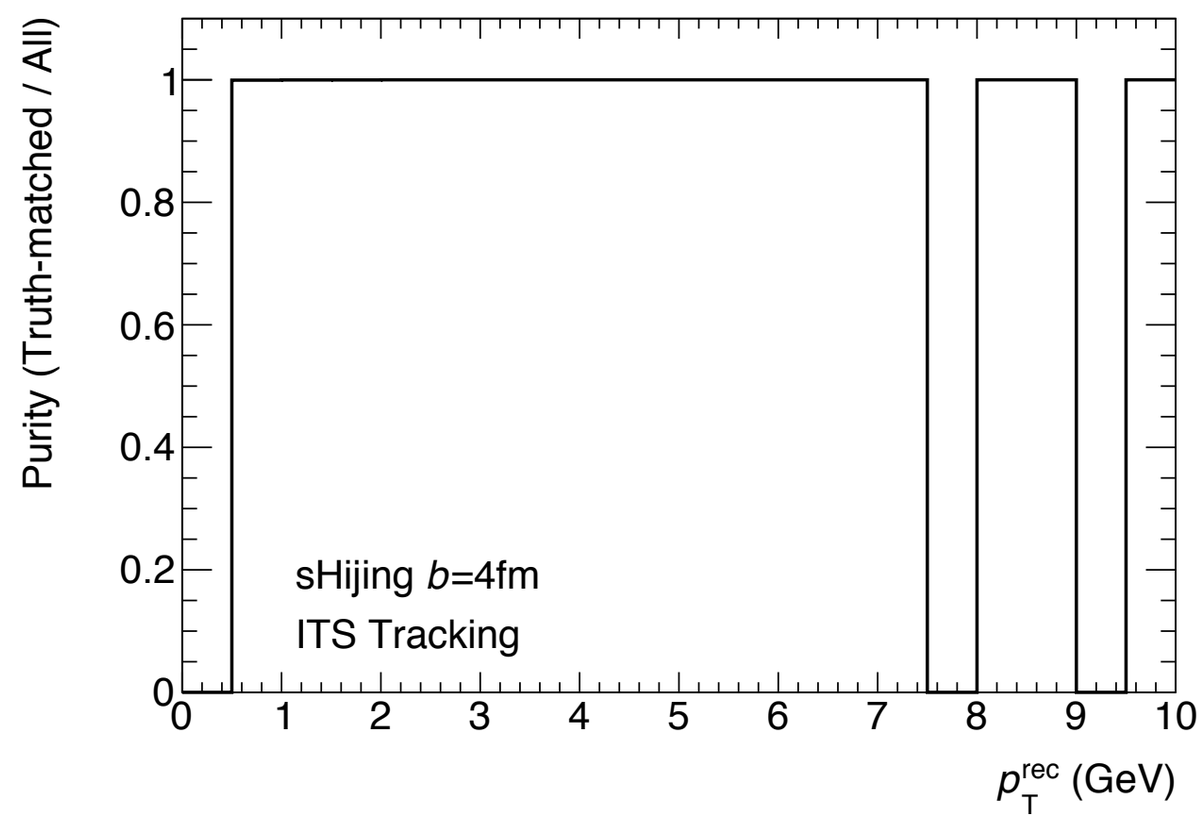


- b=4fm sHijing only
- Each <u>panel</u> is a fixed <u>tracking configuration</u> option
  - ➡ breakdown by **Truth-matched** (primary Hijing or secondary) and **fake tracks**

Purity

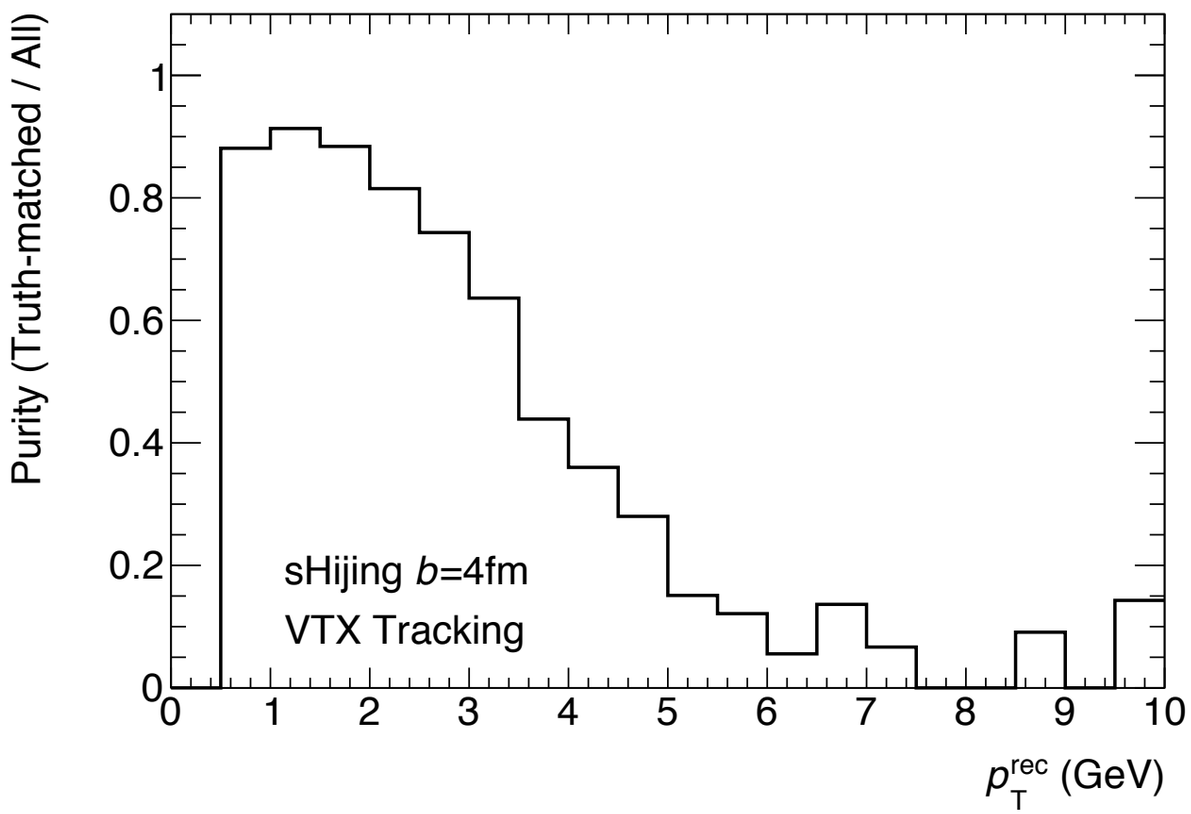


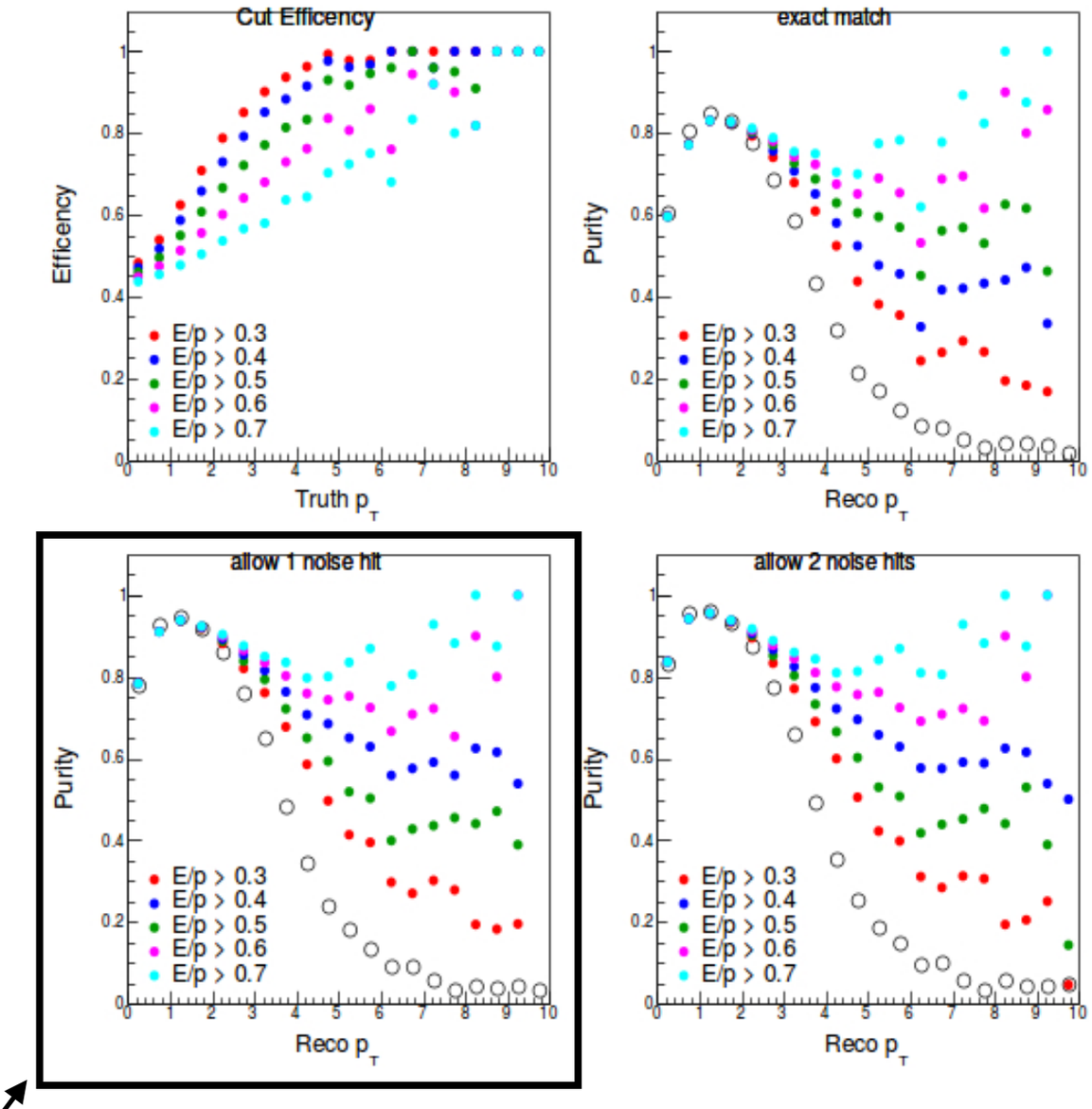




- b=4fm sHijing only
- Each <u>panel</u> is a fixed <u>tracking configuration</u> option
  - ➡ showing Purity = (**Truth-matched**) / (**Truth-matched** + **fake tracks**)

Comparison of purities





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- ➡ Most appropriate comparison is open circles in this panel (1 noise hit, no E/p match)
  - ➡ qualitatively similar to my results on the left